

## PATENT COOPERATION TREATY

PCT

## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents  
 United States Patent and Trademark  
 Office  
 Box PCT  
 Washington, D.C.20231  
 ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year)

05 May 2000 (05.05.00)

International application No.

PCT/GB99/03241

Applicant's or agent's file reference

RSJ05825WO

International filing date (day/month/year)

30 September 1999 (30.09.99)

Priority date (day/month/year)

01 October 1998 (01.10.98)

Applicant

JONES, Ian, Anthony et al

1. The designated Office is hereby notified of its election made:



in the demand filed with the International Preliminary Examining Authority on:

04 April 2000 (04.04.00)



in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was

was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO  
 34, chemin des Colombettes  
 1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

Pascal Piriou

Telephone No.: (41-22) 338.83.38

## PATENT COOPERATION TREATY

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REC'D 18 JAN 2001

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## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

|   |  |  |
|---|--|--|
| Applicant's or agent's file reference<br>RSJ05825WO                                       | See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)<br><b>FOR FURTHER ACTION</b> |  |
| International application No.<br>PCT/GB99/03241   | International filing date (day/month/year)<br>30/09/1999   | Priority date (day/month/year)<br>01/10/1998 |
| International Patent Classification (IPC) or national classification and IPC<br>B23K26/00 |  |  |
| Applicant<br>THE WELDING INSTITUTE et al.   |  |  |

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.



2. This REPORT consists of a total of 5 sheets, including this cover sheet.

- ☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☒ Certain observations on the international application

|   |   |
|---|---|
| Date of submission of the demand<br>04/04/2000  | Date of completion of this report<br>20.11.2000   |
| Name and mailing address of the international preliminary examining authority:<br> European Patent Office<br>D-80298 Munich<br>Tel. +49 89 2399 - 0 Tx: 523656.epmu d<br>Fax: +49 89 2399 - 4465 | Authorized officer<br>De Backer, T<br>Telephone No. +49 89 2399 7403<br> |

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB99/03241

## I. Basis of the report

1. This report has been drawn on the basis of *(substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments (Rules 70.16 and 70.17).)*:

### Description, pages:

|      |                     |            |                           |
|------|---------------------|------------|---------------------------|
| 3-11 | as originally filed |            |                           |
| 1,2  | as received on      | 23/10/2000 | with letter of 20/10/2000 |

### Claims, No.:

|      |                     |            |                           |
|------|---------------------|------------|---------------------------|
| 2-21 | as originally filed |            |                           |
| 1    | as received on      | 23/10/2000 | with letter of 20/10/2000 |

### Drawings, sheets:

|     |                     |
|-----|---------------------|
| 1/1 | as originally filed |
|-----|---------------------|

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

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International application No. PCT/GB99/03241

welded workpiece. No other indications in prior art are provided for solving the problem as proposed by the invention.

2. Claims 2-20 are dependent on claim 1 and as such also meet the requirements of the PCT with respect to novelty and inventive step (Art. 33(2) and Art. 33(3) PCT).

3. The subject-matter of claim 21, understood as explained in item VIII is not new (Art. 33(2) PCT), see document DE-A-19814298, fig. 1, as this figure shows two workpieces with a visual transmissive material in one of the workpieces (column 2, line 15).

**Re Item VII**

Certain defects in the international application

1. Independent claim 1 is not in the two-part form in accordance with Rule 6.3(b) PCT, which in the present case would be appropriate, with those features known in combination from the prior art (document D1) being placed in the preamble (Rule 6.3(b)(i) PCT) and with the remaining features being included in the characterising part (Rule 6.3(b)(ii) PCT).

WELDING METHOD

The present invention relates to a method of forming  
5 a weld between two workpieces, over a joint region.

Transmission laser welding is a technique which has  
been developed for welding together materials such as  
plastics. This is achieved by positioning two plastic  
members in contact, one of which is transparent, the other  
10 of which is opaque to visible light. The region of contact  
between the two plastic members is then exposed to a laser  
beam. The laser beam passes through the transparent  
plastic member and is absorbed by the second opaque plastic  
member. This causes the opaque plastic member to heat up  
15 causing the region of contact between the two plastic  
members to melt, thereby forming a weld. Examples are  
described in "Laser-transmission welding of PE-HD",  
Kunststoffe 87 (1997) 3, pp 348-350; Puetz H et al, "Laser  
welding offers array of assembly advantages", Modern  
20 Plastics International, September 1997; Haensch D et al,  
"Joining hard and soft plastics with a diode laser",  
Kunststoffe 88 (1998) 2, pp 210-212; and Jones I A,  
"Transmission laser welding of plastics", Bulletin of The  
Welding Institute, May/June 1998, and US-A-5893959.

25 All these methods are limited by the need to provide  
at least one workpiece which is opaque to visible light.

In accordance with the present invention, we provide  
a method of forming a weld between workpieces over a joint  
region, the method comprising exposing the joint region to  
30 incident radiation having a wavelength outside the visible  
range so as to cause melting of the surface of one or both  
workpieces at the joint region, and allowing the melted  
material to cool thereby welding the workpieces together,  
the method further comprising providing a radiation  
35 absorbing material at the joint region in one of the  
workpieces or between the workpieces which has an  
absorption band matched to the wavelength of the incident

radiation so as to absorb the incident radiation and generate heat for the melting process, the radiation absorbing material being visually transmissive so that the material does not substantially affect the appearance of the joint region or the workpieces in visible light.

Accordingly, we provide a method for welding workpieces which can produce a visually transmissive weld. This is achieved by including visually transmissive material at the joint region which absorbs radiation outside the visible spectrum. The joint region is then exposed to radiation of this wavelength, causing the joint region to heat up. This in turn causes the workpieces to melt such that a weld is formed between the two workpieces. If the workpieces and the joint region are themselves transmissive to visible radiation, the weld is also at least translucent to the naked eye.

The workpieces may be opaque and have similar or dissimilar colours and/or be transparent or translucent to visible light.

In some cases, the material absorbent to the radiation is included in one of the workpieces.

In other cases, two workpieces may be welded together with the material being sandwiched between the two workpieces. This then enables workpieces which do not include a suitable radiation absorbing material to be welded together.

The radiation absorbing materials, which are typically in the form of additives, may comprise dyes or pigments while the use of an additive allows standard plastics and other materials to be readily modified to allow welding by the new method. Dyes are preferred to pigments because the particulate nature of pigments means that light scattering occurs and light absorption efficiency is reduced. In addition the low molar absorption coefficients of pigments means that higher concentrations have to be used to produce a given heating effect, and apart from the cost disadvantages, this can lead to undesirable changes in the

CLAIMS

1. A method of forming a weld between workpieces over a joint region, the method comprising:
  - 5 exposing the joint region to incident radiation having a wavelength outside the visible range so as to cause melting of the surface of one or both workpieces at the joint region, and allowing the melted material to cool thereby welding the workpieces together, the method further
  - 10 comprising providing a radiation absorbing material at the joint region in one of the workpieces or between the workpieces which has an absorption band matched to the wavelength of the incident radiation so as to absorb the incident radiation and generate heat for the melting
  - 15 process, the radiation absorbing material being visually transmissive so that the material does not substantially affect the appearance of the joint region or the workpieces in visible light.
2. A method according to claim 1, wherein the radiation
- 20 absorbing material is sandwiched between two workpieces.
3. A method according to claim 1, wherein the radiation absorbing material is provided in at least one of the workpieces.
4. A method according to claim 1, wherein the radiation
- 25 absorbing material is provided on the substrate by moulding the substrate in a mould with an insert formed by or including the radiation absorbent material.
5. A method according to claim 1, wherein the radiation absorbent material is provided as a coating on the
- 30 substrate.
6. A method according to claim 1, wherein the radiation absorbent material is provided by coextruding the material with the substrate.
7. A method according to any of the preceding claims,
- 35 wherein the radiation absorbing material is exposed to radiation prior to positioning the workpieces together.



## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

|   |  |  |
|---|--|--|
| (51) International Patent Classification <sup>7</sup> :<br><b>B23K 26/00</b>  | <b>A1</b>  | (11) International Publication Number: <b>WO 00/20157</b><br>(43) International Publication Date: 13 April 2000 (13.04.00) |
| <p>(21) International Application Number: PCT/GB99/03241</p> <p>(22) International Filing Date: 30 September 1999 (30.09.99)</p> <p>(30) Priority Data:<br/>9821375.4 1 October 1998 (01.10.98) GB</p> <p>(71) Applicant (for all designated States except US): THE WELDING INSTITUTE [GB/GB]; Granta Park, Great Abington, Cambridge CB1 6AL (GB).</p> <p>(72) Inventors; and<br/>(75) Inventors/Applicants (for US only): JONES, Ian, Anthony [GB/GB]; Bardsfield Cottage, Hadstock, Cambridge CB1 6NX (GB). WISE, Roger, Jeremy [GB/GB]; 130 Exning Road, Newmarket (GB).</p> <p>(74) Agent: GILL JENNINGS &amp; EVERY; Broadgate House, 7 Eldon Street, London EC2M 7LH (GB).</p>   | <p>(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).</p> <p>Published<br/>With international search report.</p> |  |
| <p>(54) Title: WELDING METHOD</p> <div> </div> <p>(57) Abstract</p> <p>A method of forming a weld between workpieces (1, 2) over a joint region (3). The method comprises: exposing the joint region (3) to incident radiation (4) having a wavelength outside the visible range so as to cause melting of the surface of one or both workpieces at the joint region, and allowing the melted material to cool thereby welding the workpieces together. A radiation absorbing material is provided at the joint region (3) in one of the workpieces (1,2) or between the workpieces which has an absorption band matched to the wavelength of the incident radiation so as to absorb the incident radiation and generate heat for the melting process. The absorption band lies outside the visible range so that the material does not affect the appearance of the joint region (3) or the workpieces (1, 2) in visible light.</p> |  |  |



# INTERNATIONAL SEARCH REPORT

Internat. Application No

PCT/GB 99/03241

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 7 B23K26/00

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B23K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category <sup>2</sup> | Citation of document, with indication, where appropriate, of the relevant passages  | Relevant to claim No.       |
|-----------------------|---|-----------------------------|
| X                     | EP 0 282 181 A (IMPERIAL CHEMICAL INDUSTRIES PLC)<br>14 September 1988 (1988-09-14)<br>page 3, line 46 - line 52<br>----- | 1, 3, 9,<br>11-15,<br>17-21 |
| A                     | US 4 606 859 A (DAGGAN ET AL.)<br>19 August 1986 (1986-08-19)<br>column 6, line 27 - line 42<br>-----                     | 1-9                         |

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

<sup>2</sup> Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

12 January 2000

Date of mailing of the international search report

19/01/2000

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
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Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Herbreteau, D

# INTERNATIONAL SEARCH REPORT

Information on patent family members

Internal . Application No

PCT/GB 99/03241

| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s) | Publication<br>date |
|---|---------------------|----------------------------|---------------------|
| EP 0282181 A                              | 14-09-1988          | AT 113978 T                | 15-11-1994          |
|   |                     | AU 1212788 A               | 08-09-1988          |
|   |                     | CA 1330435 A               | 28-06-1994          |
|   |                     | DE 3852050 D               | 15-12-1994          |
|   |                     | DE 3852050 T               | 06-04-1995          |
|   |                     | JP 2614890 B               | 28-05-1997          |
|   |                     | JP 63308073 A              | 15-12-1988          |
|   |                     | KR 9601062 B               | 18-01-1996          |
|   |                     | US 4824947 A               | 25-04-1989          |
| US 4606859 A                              | 19-08-1986          | AT 51402 T                 | 15-04-1990          |
|   |                     | BR 8501253 A               | 12-11-1985          |
|   |                     | EP 0155780 A               | 25-09-1985          |
|   |                     | HK 65390 A                 | 31-08-1990          |
|   |                     | JP 2012921 C               | 02-02-1996          |
|   |                     | JP 4075916 B               | 02-12-1992          |
|   |                     | JP 60209583 A              | 22-10-1985          |
|   |                     | KR 9400369 B               | 19-01-1994          |
|   |                     | PH 21552 A                 | 11-12-1987          |
|   |                     | SG 45490 G                 | 17-08-1990          |

# PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

|  |   |  |
|--|---|--|
| Applicant's or agent's file reference<br><b>RSJ05825W0</b> | <b>FOR FURTHER ACTION</b> see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below. |  |
| International application No.<br><b>PCT/GB 99/ 03241</b>   | International filing date (day/month/year)<br><b>30/09/1999</b>   | (Earliest) Priority Date (day/month/year)<br><b>01/10/1998</b> |
| Applicant<br><b>THE WELDING INSTITUTE et al.</b>           |   |  |

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 2 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

### 1. Basis of the report

a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

☒ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

1  
☐ None of the figures.

## INTERNATIONAL SEARCH REPORT

International Application No  
PCT/GB 99/03241A. CLASSIFICATION OF SUBJECT MATTER  
IPC 7 B23K26/00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
IPC 7 B23K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages                                      | Relevant to claim No.       |
|------------|---|-----------------------------|
| X          | EP 0 282 181 A (IMPERIAL CHEMICAL INDUSTRIESPLC)<br>14 September 1988 (1988-09-14)<br>page 3, line 46 - line 52<br>---- | 1, 3, 9,<br>11-15,<br>17-21 |
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☐ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

## \* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

Date of the actual completion of the international search

12 January 2000

Date of mailing of the international search report

19/01/2000

Name and mailing address of the ISA

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Authorized officer

Herbreteau, D

## INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 99/03241

| Patent document<br>cited in search report |   | Publication<br>date | Patent family<br>member(s) | Publication<br>date |
|---|---|---------------------|----------------------------|---------------------|
| EP 0282181                                | A | 14-09-1988          | AT 113978 T                | 15-11-1994          |
|   |   |                     | AU 1212788 A               | 08-09-1988          |
|   |   |                     | CA 1330435 A               | 28-06-1994          |
|   |   |                     | DE 3852050 D               | 15-12-1994          |
|   |   |                     | DE 3852050 T               | 06-04-1995          |
|   |   |                     | JP 2614890 B               | 28-05-1997          |
|   |   |                     | JP 63308073 A              | 15-12-1988          |
|   |   |                     | KR 9601062 B               | 18-01-1996          |
|   |   |                     | US 4824947 A               | 25-04-1989          |
| <hr/>                                     |   |                     |                            |                     |
| US 4606859                                | A | 19-08-1986          | AT 51402 T                 | 15-04-1990          |
|   |   |                     | BR 8501253 A               | 12-11-1985          |
|   |   |                     | EP 0155780 A               | 25-09-1985          |
|   |   |                     | HK 65390 A                 | 31-08-1990          |
|   |   |                     | JP 2012921 C               | 02-02-1996          |
|   |   |                     | JP 4075916 B               | 02-12-1992          |
|   |   |                     | JP 60209583 A              | 22-10-1985          |
|   |   |                     | KR 9400369 B               | 19-01-1994          |
|   |   |                     | PH 21552 A                 | 11-12-1987          |
|   |   |                     | SG 45490 G                 | 17-08-1990          |
| <hr/>                                     |   |                     |                            |                     |



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Team: OIPEBackFileIndexing  
Dossier: 09806613

Legal Date: 08-25-2001

| No. | Docode | Number of pages |
|-----|--------|-----------------|
| 1   | M903   | 1               |

Total number of pages: 1

Remarks:

Order of re-scan issued on .....